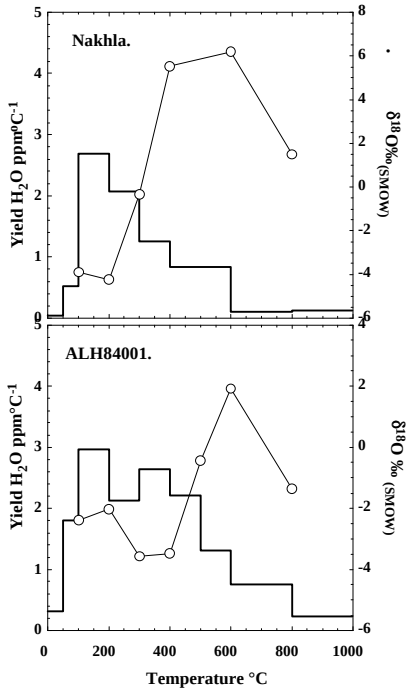
OXYGEN ISOTOPES IN WATER FROM MARTIAN METEORITES. L. Baker, I. A.Franchi, I. P.Wright, and C. T. Pillinger, Planetary Sciences Research Institute, The Open University, Milton Keynes, MK7 6AA, UK. (L.Baker@open.ac.uk).

Introduction: Those meteorites of supposed martian origin which have been analysed thus far, have water contents of between 0.04 and 0.4 wt % [1,2]. A complete understanding of the nature and origins of this "water" is of paramount importance. One potentially useful way forward is through measurement of stable isotopic compositions (δD, $\delta^{17}O$ and $\delta^{18}O$). Herein we apply our new water pyrolysis technique [3] to the problem in order to obtain oxygen three isotope information.

Technique: We used ~50 mg samples of two different martian meteorites, Nakhla and ALH84001. These were pyrolised over a range of temperatures from 50 –1000°C in 100° steps of about 20 minutes duration. Volatiles evolved were swept directly onto a fluorinating agent (CoF_3), where water was converted to O gas. The reaction by-product, HF, together with any other contaminants were removed by chemical and cryogenic traps. A GC column further purified the sample before passage to the mass spectrometer.

Results: The two samples analysed herein are shown in Fig. 1. Whilst Nakhla has been analyzed previously in a different laboratory [1] this is the first time that the O isotopic composition of water in ALH84001 has been determined. Nakhla shows a simple water release curve with a peak at lower temperatures of ~200-300°C before tailing off at higher temperatures. The $\delta^{18}O$ values show a similar but more pronounced trend than that previously observed by [1] with a distinct low temperature component and another at higher temperatures. The better resolution of the $\delta^{18}O$ signal may be the result of our rigorous efforts to reduce memory effects. The profile of ALH84001 shows that more water is retained to higher temperatures, the yield not tailing off until after the 500°C temperature step. The release up to 500°C shows two peaks each of which appears to have a distinct $\delta^{18}O$ signature. In common with Nakhla, $\delta^{18}O$ reaches a peak value at about 600°C before falling again at higher temperatures. $\Delta^{17}O$ values (not shown for reasons of clarity) from Nakhla are very similar to those published previously [1]. Equivalent data from ALH84001 show a similar overall pattern to Nakhla demonstrating the presence of isotopically distinctive water components.

Discussion: In a previous study of D/H ratios from eight martian meteorites [2] water released up to about 300°C had δD values compatible with water of terrestrial origin. That released at higher temperatures had δD values between +100 and +2000‰, suggestive of a martian origin for this component as the atmospheric δD of Mars is about +4,000‰ [4]. For the samples analyzed herein, water released at low temperatures is dominated by terrestrial contamination. In the case of Nakhla this appears to be represented by a single peak at 200°C, perhaps representing a single period of terrestrial alteration. In contrast the release from ALH84001 shows evidence of two distinct components at low temperatures, one at 200°C and one at 400°C. This is suggestive of a more complex terrestrial alteration history, in keeping with its relatively longer terrestrial age. Exposure to isotopically light Antarctic ice may also explain the relatively lower $\delta^{18}O$ signal from the high temperature steps which peak at +2‰ as opposed to +6‰ for Nakhla.



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